Description

Method for effecting wireless communication between radio stations and device for carrying out the method

The small dimensions of modern communication terminals, coupled with the high performance capability of the components used in their processors and memories, make them suitable for the most widely diverse mobile applications which in the first instance have nothing at all to do with their main application, telecommunications. Such applications include, among others, those referred to as "point-of-sale applications", that is, those in which the device mainly fulfils the functions of an electronic means of payment, and also include security applications, in which the device acts as a means of identification or authentication. In the final analysis, "point-of-sale applications" are simply special cases of the security applications, possibly with some additional design features, since in an electronic payment procedure it is usual for the payee and often also the payer to need to prove the identity and authorisation of the other party.

Other small devices, for example those known as personal digital assistants (PDA), with or without a telecommunication module, are also mostly suitable for such applications, provided they have a suitable interface for data transmission. Most of these interfaces have been known for a long time. Examples include infrared interfaces or short-range interfaces such as those made to the "bluetooth" standard.

Short-range contactless ("wireless") data transmission interfaces are particularly suitable for local communication. For this type of application they have the advantage that from the outset the group of possible communication partners is restricted to the immediate surroundings, which is often a fairly small area. Even today temporary connections can be established between PDAs for the purpose of transferring "electronic visiting cards" or other data by

placing these PDAs in very close proximity and/or pointing their infrared interfaces towards one another. One can then be reasonably certain (which for many applications is sufficient) that the communication which is taking place is actually with the required communication partner.

This known method is often insufficient for applications with greater security requirements. There would be too great a danger that an unseen or unnoticed third party could break into the intended purely bilateral communication without being detected at first, and data could be exchanged with a communication partner other than the communication partner required. The object of the present invention is to remedy this situation.

This object is achieved by means of a method or a device according to one of the independent Claims.

Further developments of the invention are set out in the sub-claims.

The invention is described below with reference to exemplary embodiments and with the aid of figures.

For this purpose Figure 1 shows a diagram of a typical application situation and its solution according to the invention.

Figure 2 is a diagram showing the manner of processing the special case in which from the outset only a second radio station is located in the vicinity of the first radio station.

The present invention is based on the fundamental idea that, in many applications, the intended communication partner differs, e.g. by his position or other features, which are easily influenced by the user, from all other potential and unintended communication partners (third parties) in such a manner that the transmission features of the contactless interface (that is, for example, of the radio channel) between him and a first radio station (FS1), which is

seeking to set up the connection, fulfil a specified quality criterion that is not fulfilled by all other potential communication partners or in such a manner that such a difference in the transmission features can be brought about at least by modifying at least one operating parameter of the first radio station (FS1).

A simple and typical example of such a situation is shown in Figure 1. In the vicinity of the first radio station (FS1), which intends to establish a connection with a second radio station, are several second radio stations (FS2a to FS2d). The first radio station could be part of a cash-desk system in a department store, for example. The second radio stations (FS2a to FS2d) may be thought of as mobile telephones or other small devices which are all able to make contact with the first radio station (FS1). These second radio stations are usually in the possession of different people who as a rule are customers or potential customers of the store.

One of these customers approaches the radio station (FS1) of the cash-desk system in order to pay for a chosen item with the aid of the second radio station (FS2b). In order for the payment transaction to proceed correctly it is now very important that a purely bilateral connection or relationship for communication purposes should be established and maintained between the radio stations (FS1 and FS2b) of the rightful participants in the payment transaction, because otherwise it would easily be possible for third parties to break in and the correct processing of such wireless payment transactions could not be guaranteed.

This is because the radio station FS1 cannot initially "know" how to recognise the radio station FS2b of any given customer. It would therefore be relatively easy for any third party to operate their own radio station in such a way that the cash-desk system carries out the payment transaction on the third-party radio station, when it might even be a refund in the course of exchanging goods.

However, as the diagram in Figure 1 shows, the radio station FS2b is

now distinguished from all other radio stations by being the closest to the cash-desk system (FS1). Consequently it should be possible to change the transmission power or the reception sensitivity of the radio station FS1 in such a way that a connection or relationship for communication purposes is possible only with this one radio station FS2b.

This can be achieved by, for instance, gradually reducing the transmission power or reception sensitivity of the radio station FS1 in the cash-desk system. For this purpose the first radio station (FS1) could transmit a first call signal or connection request signal (cr1) initially at a fairly high transmission power so that it has enough range for all four of the second radio stations shown in Figure 1 to be able to receive this signal. In this step all four second radio stations then each transmit a response signal (r2a to r2d), so that if the initial reception sensitivity is high enough, all four response signals can be received by the first radio station FS1.

In the next step the transmission power of the first radio station FS1 can now be reduced on a trial basis. Alternatively the reception sensitivity could be reduced. It would also be possible to reduce both quantities at the same time.

If the corresponding operating parameters are chosen appropriately, then after no more than a few such steps at least one of the four second radio stations will cease to respond or its response will no longer be received by the first radio station. For example if the transmission power is reduced so far that the connection request signal cr2 no longer reaches the second radio station FS2c, that radio station stops responding. The other three second radio stations (FS2a, FS2b and FS2d) continue to respond, however, because they can receive the signal cr2. Then in the next step the transmission power of the first radio station FS1 could be reduced further so that for example only FS2b continues to respond, or the reception sensitivity could be reduced to the extent that only the

response from FS2b can be received.

However the transmission power could also be reduced further, so that a third connection request signal cr3 no longer reaches the second radio stations FS2a, FS2c and FS2d, but still reaches the second radio station FS2b. In this case only the second radio station FS2b would still transmit a response r2b which the first radio station FS1 could receive.

In more general terms, in practically all situations in which the distance ratios or propagation ratios between the individual radio stations are sufficiently different, it will be possible to set suitable operating parameters of the first radio station FS1 in such a way that a connection or relationship for communication purposes exists or can be maintained only with one particular second radio station.

At certain places in this patent application a distinction is made between a connection for communication purposes and a relationship for communication purposes. The reason for this is that the term (communication) connection is frequently used for situations in which useful data is actually transmitted. The somewhat more general term (communication) relationship is intended to express that frequently such a transfer of useful data is not really necessary in order to achieve the purpose of the invention. In many cases it is enough that, for example, the receive field strength at the receiver reaches or exceeds a minimum value. If this applies to only one particular second radio station FS2b, it is then possible to speak of a purely bilateral communication relationship between this particular second radio station FS2b and the first radio station FS1, even though a communication connection in the narrower sense of the word does not actually exist. In the particular context of the description of this invention therefore, both terms are occasionally to be understood in such a way that either term could stand for the other.

It is for example possible to use the application to establish a communication connection between a cash-desk system (ST) having a wireless module and a customer device (CD) having a wireless module (WM), in particular with a mobile telephone (MP). Generally several people with such customer devices are to be found in a sales area, for instance waiting in a queue at the cash desk. For a particular payment transaction, the cash-desk system wishes to make contact exclusively with the customer device closest to the cash desk. This in fact makes it very easy to ensure that it is actually the customer device of the customer currently paying which is taking part in the electronic payment transaction and not the device of another customer in the cash-desk queue or elsewhere in the sales area.

It is an advantage of the method according to the invention that no participating device needs to know anything about the address or identifier of any other device. Using such addresses or identifiers is of course another way of ensuring that only the "correct" devices take part in the payment transaction. For example anyone using the system could perhaps manually enter into the cash-desk system a device identifier for the customer device taking part in the payment transaction, this identifier being unknown to anyone else present. This would be very complicated for the applications being considered. It is therefore an advantage of the method according to the invention that this complicated and possibly error-prone procedure can be dropped.

The cash-desk system, or in more general terms a service terminal (ST), can instead transmit a device address or device identification directly over the radio path to the actual customer device concerned once the communication relationship between both is truly bilateral. By using such a device address, which could be temporary, that is to say only valid for the current payment transaction, the communication can then be secured against inadvertent interference or third-party attack, even should the criterion of the shortest physical distance no longer be fulfilled after this protection has

been established. The method according to the invention does not require an address to be input from outside, that is, other than via the radio path.

The customer actually involved in the payment transaction thus has to bring the mobile telephone or other customer device close to the cash-desk or service terminal only once and then can move further away, even while the payment transaction is still in progress. This characteristic of the invention makes the process of handling the payment transaction significantly more convenient for the people involved.

A further advantageous application of the invention is possible in connection with logging subscriber stations (SM) onto base stations (BS) of cellular or other wireless communication systems, in particular cordless telephone systems according to the DECT standard. When systems of this kind are being started up for the first time or additional subscriber stations such as those acquired subsequently are used, any subscriber stations that have not yet been logged onto the system must first be logged on.

This normally takes place in the context of a log-on procedure which in principle carries with it the risk that, unknown to the authorised user, unauthorised third parties could also log onto the system. This is because the base station cannot "know" how to recognise the authorised user's subscriber station. In general, however, it is very easy for an authorised user intending to carry out the log-on procedure to go to the area in which the base station is located and approach the base station so closely that it is virtually impossible for any device used by an eavesdropper to be closer to the base station than the device operated by the authorised user.

Therefore if more than one device is located in the area of the base station during the log-on procedure, the base station need simply reduce its transmission power, for example, until just one

communication with the subscriber device to be logged on is still possible. This method also has the advantage that the devices concerned can identify each other directly via the external interface (i.e. via the radio channel) without transmitting any identification information externally.